ESO 792

Fertilizer Application Rate for Economically Optimum Crop Yields

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Procedure for determining rate	Example	Your Data
1a. List crop to be grown	corn	
b. List nutrient to be applied	P_2O_5	
Compute marginal prices of crop and nutrient		
a. Marginal price of crop =		
Selling price (¢/bu.)	3.30	
Storage & marketing (¢/bu.)	- .10	
Drying (¢/bu.)	- .10	
Total (¢/bu.)	3.10	
b. Marginal price of nutrient		
Purchase price (¢/lb.)	.23	
+ Application cost (¢/lb.)		
$\frac{\text{cost per acre}}{\text{yield}}$ =	$\frac{3.00}{150}$	
¢/lb.	.25	
2. Compute ratio of nutrient price to crop price		
$\frac{\text{Marginal price of nutrient (¢/lb.)}}{\text{Marginal price of grain ($/bu.)}}$	$\frac{.25}{3.10}$	
=	.08	
3. Select that application rate where additional product from an additional pound of nutrient approximates ratio of nutrient price to grain price		
a. Soil test	25	
b. Economically optimum rate from Tables 1 through 7	60+	

Table 1. Additional Corn (Bushels) from an Additional Pound of Nitrogen

Nitrogen Application Rate	Additional Corn
lbs/acre	-Δ corn (bushels)/Δ N (lb.) -
10	1.195
20	.982
30	.808
40	.664
50	.546
60	.449
70	.369
80	.303
90	.249
100	.205
110	.168
120	.138
130	.114
140	.093
150	.077
160	.063
170	.052
180	.042
190	.035
200	.029
210	.023
220	.019
230	.016
240	.013
250	.010

Table 2. Additional Corn (Bushels) from an Additional Pound of Phosphate P_2O_5 at Alternative Phosphate Application Rates

Phosphate Application Rate	Phosphorus Test Level			
	15	25	35	45
lbs/acre	- Δ corn (bushels)/Δ P_2O_5 (lb.)-			
5	.693	.257	.095	.035
10	.624	.232	.086	.032
15	.562	.208	.077	.028
20	.506	.188	.069	.025
25	.456	.169	.062	.023
30	.410	.152	.056	.021
35	.369	.137	.051	.018
40	.333	.123	.045	.017
45	.299	.111	.041	.015
50	.270	.100	.037	.013
55	.243	.090	.033	.012
60	.219	.081	.030	.011
65	.197	.073	.027	.010
70	.177	.066	.024	.009
75	.159	.059	.022	.008
80	.144	.053	.019	.007
85	.129	.048	.017	.006
90	.116	.043	.016	.005
95	.105	.039	.014	.005
100	.094	.035	.013	.004
105	.085	.031	.011	.004
110	.076	.028	.010	.003
115	.069	.025	.009	.003
120	.062	.023	.008	.003
125	.056	.020	.007	.002
130	.050	.018	.006	.002
135	.045	.016	.006	.002
140	.040	.015	.005	.002
145	.036	.013	.005	.001
150	.033	.012	.004	.001

Table 3. Additional Corn (Bushels) from an Additional Pound of Potash (K_2O) at Alternative Potash Application Rates

Potash Application Rate	Potassium Test Level			
	150	200	250	300
lbs/acre	- Δ corn (bushels)/Δ K_2O (lb.)			
10	.270	.129	.061	.029
20	.224	.107	.051	.024
30	.186	.089	.042	.020
40	.155	.074	.035	.017
50	.129	.061	.029	.014
60	.107	.051	.024	.011
70	.089	.042	.020	.009
80	.074	.035	.017	.008
90	.061	.029	.014	.006
100	.051	.024	.011	.005
110	.042	.020	.009	.004
120	.035	.017	.008	.003
130	.029	.014	.006	.003
140	.024	.011	.005	.002
150	.020	.009	.004	.002
160	.017	.008	.003	.001
170	.014	.006	.003	.001
180	.011	.005	.002	.001
190	.009	.004	.002	.001
200	.008	.003	.001	.000
210	.006	.003	.001	.000
220	.005	.002	.001	.000
230	.004	.002	.001	.000
240	.003	.001	.000	.000

Table 4. Additional Soybeans (Bushels) from an Additional Pound of Phosphate (P_2O_5) at Alternative Phosphate Application Rates

Phosphate Application Rate	Phosphorus Test Level			
	15	25	35	45
lbs/acre	- Δ soybeans (bushels)/Δ P_2O_5 (lb)-			
5	.107	.031	.008	.002
10	.099	.028	.008	.002
15	.091	.026	.007	.002
20	.084	.024	.007	.002
25	.077	.022	.006	.001
30	.071	.020	.005	.001
35	.065	.019	.005	.001
40	.060	.017	.005	.001
45	.055	.016	.004	.001
50	.051	.014	.004	.001
55	.047	.013	.003	.001
60	.043	.012	.003	.001
65	.040	.011	.003	.000
70	.037	.010	.003	.000
75	.034	.009	.002	.000
80	.031	.009	.002	.000
85	.029	.008	.002	.000
90	.026	.007	.002	.000
95	.024	.007	.002	.000
100	.022	.006	.001	.000
105	.020	.006	.001	.000
110	.019	.005	.001	.000
115	.017	.005	.001	.000
120	.016	.004	.001	.000
125	.015	.004	.001	.000
130	.013	.004	.001	.000
135	.012	.003	.001	.000
140	.011	.003	.000	.000
145	.010	.003	.000	.000
150	.010	.002	.000	.000

Table 5. Additional Soybeans (Bushels) from an Additional Pound of Potash (K_2O) at Alternative Potash Application Rates

Potash Application Rate	Potassium Test Level			
	150	200	250	300
lbs/acre	- Δ soybeans (bushels)/Δ K_2O (lb) -			
10	.348	.224	.145	.093
20	.242	.156	.101	.065
30	.168	.109	.070	.045
40	.117	.075	.049	.031
50	.081	.052	.034	.022
60	.057	.036	.023	.015
70	.039	.025	.016	.010
80	.027	.017	.011	.007
90	.019	.012	.008	.005
100	.013	.008	.005	.003
110	.009	.006	.003	.002
120	.006	.004	.002	.001
130	.004	.002	.001	.001
140	.003	.002	.001	.000
150	.002	.001	.000	.000
160	.001	.000	.000	.000
170	.001	.000	.000	.000
180	.000	.000	.000	.000
190	.000	.000	.000	.000
200	.000	.000	.000	.000

Table 6. Additional Wheat (Bushels) from an Additional Pound of Phosphate (P_2O_5) at Alternative Phosphate Application Rates

Phosphate Application Rates	Phosphorus Test Level			
	15	25	35	45
lbs/acre	- Δ wheat (bushels)/Δ P_2O_5 (lb) -			
5	.423	.207	.101	.049
10	.377	.184	.090	.044
15	.336	.164	.080	.039
20	.299	.146	.071	.035
25	.267	.130	.064	.031
30	.238	.116	.057	.027
35	.212	.103	.050	.024
40	.189	.092	.045	.022
45	.168	.082	.040	.019
50	.150	.073	.036	.017
55	.133	.065	.032	.015
60	.119	.058	.028	.014
65	.106	.052	.025	.012
70	.094	.046	.022	.011
75	.084	.041	.020	.009
80	.075	.036	.018	.008
85	.067	.032	.016	.007
90	.059	.029	.014	.007
95	.053	.026	.012	.006
100	.047	.023	.011	.005
105	.042	.020	.010	.004
110	.037	.018	.009	.004
115	.033	.016	.008	.003
120	.029	.014	.007	.003
125	.026	.013	.006	.003
130	.023	.011	.005	.002
135	.021	.010	.005	.002
140	.018	.009	.004	.002
145	.016	.008	.004	.001
150	.015	.007	.003	.001

Table 7. Additional Wheat (Bushels) from an Additional Pound of Potash (K_2O) at Alternative Potash Application Rates

Potash Application Rate	Potassium Test Level			
	150	200	250	300
lbs/acre	- Δ wheat (bushels)/Δ K_2O (lb) -			
10	.077	.037	.017	.008
20	.067	.032	.015	.007
30	.058	.027	.013	.006
40	.050	.024	.011	.005
50	.044	.021	.010	.004
60	.038	.018	.008	.004
70	.033	.015	.007	.003
80	.028	.013	.006	.003
90	.025	.012	.005	.002
100	.021	.010	.005	.002
110	.018	.009	.004	.002
120	.016	.007	.003	.001
130	.014	.006	.003	.001
140	.012	.005	.002	.001
150	.010	.005	.002	.001
160	.009	.004	.002	.001
170	.008	.003	.001	.000
180	.007	.003	.001	.000
190	.006	.002	.001	.000
200	.005	.002	.001	.000
210	.004	.002	.001	.000
220	.004	.001	.000	.000

Production Functions Used in Analysis

Table 1 $\log \frac{A-Y}{A} = -.0085\ (N)$ where $A = 75$

Table 2 $\log \frac{A-Y}{A} = -.043\ (\text{P test}) - .0091\ (P_2O_5)$ where $A = 164$

Table 3 $\log \frac{A-Y}{A} = -.0064\ (\text{K test}) - .008\ (K_2O)$ where $A = 162.2$

Table 4 $\log \frac{A-Y}{A} = -.054\ (\text{P test}) - .0071\ (P_2O_5)$ where $A = 46.5$

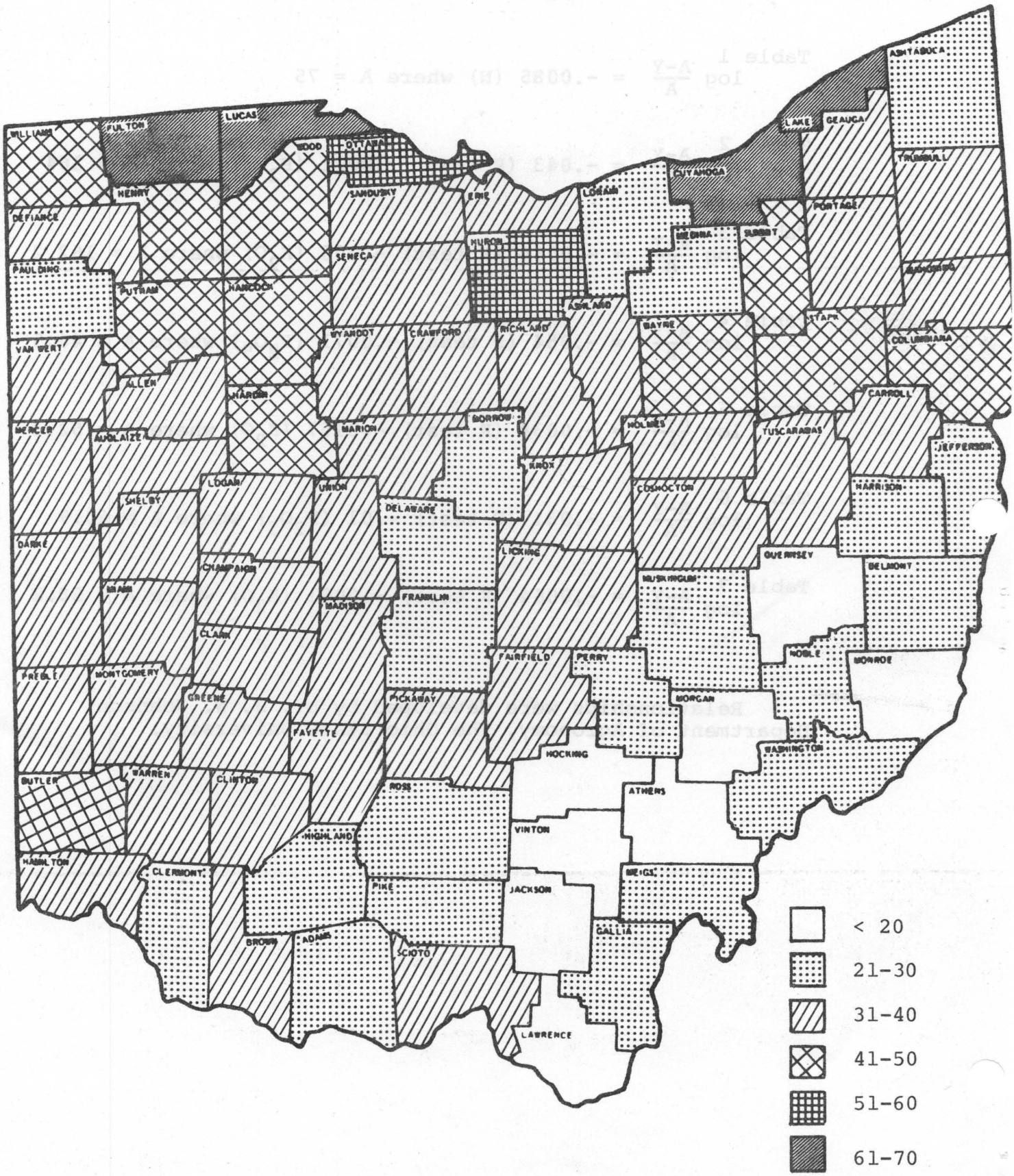
Table 5 $\log \frac{A-Y}{A} = -.0038\ (\text{K test}) - .0157\ (K_2O)$ where $A = 52.3$

Table 6 $\log \frac{A-Y}{A} = -.031\ (\text{P test}) - .01\ (P_2O_5)$ where $A = 60.9$

Table 7 $\log \frac{A-Y}{A} = -.0064\ (\text{K test}) - .0061\ (K_2O)$ where $A = 58.2$

Relationships were developed by Dr. J. W. Johnson, Department of Agronomy, The Ohio State University.

Average Phosphorus Test Level
for Ohio Counties, 1971-72



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